SPAWAR Systems Center San Diego

Space and Naval Warfare Systems Center, San Diego (SSC San Diego)

ROBOTICS UPDATE

"Providing network-integrated robotic solutions for C4ISR applications."

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Annual Publications Supplement: 2006

"FIRRE Remote Sensor Station (RSS),"
Cruickshanks, J., Wickstrand, E., Kramer, T.A., Laird, R.T., Barngrover, C.M., and Gardner, C.W., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The Remote Sensor Station (RSS) provides FIRRE with the ability to remotely control (or extend the range of) manned/unmanned sensors. FIRRE is sponsored by the Office of the Under Secretary of Defense, Acquisitions, Technology and Logistics (OUSD AT&L), and is managed by the Product Manager, Force Protection Systems (PM-FPS).

"Using Advanced Computer Vision Algorithms on Small Mobile Robots,"
Kogut, G.T., Birchmore, F., Pacis, E.B., Ahuja, G., Sights, B., and Everett, H.R., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

This paper describes the use of computer-vision algorithms to enhance the functionality and autonomy of mobile robot systems, such as object classification and human presence detection. We demonstrate the implementation and testing of two algorithms: 1) object classification using a boosted Cascade of classifiers trained with Adaboost, 2) human presence detection from a moving platform.

"FIRRE Joint Battlespace Command and Control System for Manned and Unmanned Assets (JBC2S),"
Kramer, T.A., Laird, R.T., Dinh, M., Barngrover, C.M., Cruickshanks, J.R., and Gilbreath, G.A., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The command-and-control element of FIRRE is the Joint Battlespace Command and Control System (JBC2S) for manned and unmanned assets, which is based upon the Mobile Detection Assessment Response System (MDARS), Multiple Resource Host Architecture (MRHA). JBC2S is an evolution of the MRHA that leverages over 10 years of development in unmanned systems command-and-control.

"FIRRE Command and Control Station,"
Laird, R.T., Kramer, T.A., Cruickshanks, J., Curd, K.M., Thomas, K.M., and Moneyhun, J., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The FIRRE Command and Control (C2) Station supports two operators, hosts the Joint Battlespace Command and Control Software for Manned and Unmanned Assets (JBC2S), and will be able to host Mission Planning and Rehearsal (MPR) software. The intent of the FIRRE program is to reduce manpower requirements, enhance force protection capabilities, and reduce casualties through the use of unmanned systems.

"Autonomous Navigation and Obstacle Avoidance for Unmanned Surface Vehicles,"
Larson, J., Ebken, J., Bruch, M.H., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

A description of the core technologies developed to create a robust autonomous Unmanned Surface Vehicle, focusing on autonomous navigation, obstacle avoidance, and path planning.

"Development of a UGV-mounted Automated UAV Refueling System,"
Mullens, K., Burmeister, A., Wills, M., Stroumtsos, N., and Denewiler , T., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The Autonomous UAV Mission System (AUMS) is being developed to extend the range and endurance of small VTOL UAVs used in a variety of reconnaissance and surveillance roles. Utilizing an unmanned ground vehicle as a fueling station and a means to forward deploy the UAV dramatically increases the utility of these vehicles while simultaneously minimizing their operators' exposure to hazardous environments.

"Automated Launch, Landing and Refueling Technologies for Increased UGV-UAV Effectiveness,"
Mullens, K., Burmeister, A., Wills, M., Stroumstso, N., Denewiler, T., Pachura, J., Prior, G., and Hawkins, B., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

This paper describes the latest efforts to develop the enabling technologies utilized in the Autonomous UAV Mission System (AUMS). Technologies addressed include GPS and vision-based precision landing, development of a self-centering capture mechanism for securing and fueling the UAV, and development of a refueling system with integrated safety mechanisms.

Annual Publications Supplement: 2006 (*continued*)

"Collaborative Engagement Experiment,"
Mullens, K., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

Collaboration among unmanned ground and air systems will provide the warfighter of the future significantly enhanced capabilities for operations in complex terrain. The goal of the Collaborative Engagement Experiment is to consolidate such unmanned systems research efforts of SPAWAR Systems Center San Diego (SSC San Diego), Air Force Research Laboratory (AFRL), Tyndall AFB, and the Army Aviation and Missile Research Development and Engineering Center (AMRDEC) to demonstrate potential CONOPS for teams of unmanned air and ground systems in a variety of roles.

"Mobile Detection Assessment and Response System (MDARS): a Force Protection, Physical Security Operational Success,"
Shoop, B., Johnston, M., Goehring, R., Moneyhun, J., and Skibba, B., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

MDARS is a semi-autonomous unmanned ground vehicle with intrusion detection and assessment as well as product and barrier assessment payloads. Its functions include surveillance, security, early warning, incident first response and product and barrier status, primarily focused on a depot/munitions-security mission at semi-structured facilities. MDARS is in Systems Development and Demonstration (SDD) under the Product Manager for Force Protection Systems (PM-FPS).

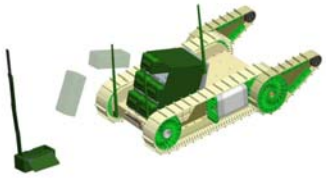
"Joint Robotics Program (JRP)-supported Efforts at Space and Naval Warfare Center, San Diego,"
Nguyen, H.G., and Everett, H.R., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The Space and Naval Warfare Systems Center, San Diego (SSC San Diego) is conducting a number of robotic research, development, evaluation, fielding, and combat-support missions and projects in support of Joint Robotics Program (JRP) goals. These include: Man-Portable Robotic System, Unmanned Surface Vessel, Automatically Deployed Communication Relays, Autonomous UAV Mission System, Robotic Systems Pool, Family of Integrated Rapid Response Equipment, and the Technology Transfer project. This paper summarizes the recent accomplishments and current status of these efforts.

"An Adaptive Localization System for Outdoor/Indoor Navigation,"
Pacis, E.B., Everett, H.R., Sights, B., and Ahuja, G., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

Under the Joint Robotics Program's Technology Transfer project, empirical evaluations of various localization approaches were conducted to assess their maturity levels and performance metrics in different exterior/interior settings. The methodologies compared include Markov localization, global positioning system, Kalman filtering, and fuzzy-logic. Characterization of these technologies highlighted their best features, which were then fused into an adaptive solution that allows seamless transition between outdoor and indoor environments and continued navigation in GPS-denied areas.

"Unmanned Ground Vehicle Non-line-of-sight Operations Using Relaying Radios,"
Pezeshkian, N., Nguyen, H.G., and Burmeister, A., IASTED Robotics and Application (RA 2006), Honolulu, Hawaii August14-16, 2006.



The paper describes the automatic deployment of relaying radios from UGVs. The system is used to maintain the communications link beyond line-of-sight as well as for range extension. The predecessor project (AMCR) and how it led into the ADCR project is briefly covered, along with progress as of August 06.

"Multi-robot Operator Control Unit,"
Powell, D.N., Gilbreath, G., Bruch, M.H., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The Multi-robot Operator Control Unit (MOCU) provides a flexible user interface for control into multiple heterogeneous unmanned vehicles and sensors. The scalable and highly configurable OCU accommodates a wide range of vehicles

"Integration of Robotic Resources to FORCEnet,"
Nguyen, C., Carroll, D., and Nguyen, H.G., SPIE Proc. 6230: Unmanned Ground Vehicle Technology VIII, Defense Security Symposium, Orlando, FL, April 17-20, 2006.

The paper discusses the challenges of interfacing robotic resources with a net-centric model. It provides a possible approach that addresses these challenges and describes how robotic resources could be utilized under the FORCEnet environment.

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